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3D BIOPRINTING OF FUNCTIONAL HYDROGELS WITH THE FUGITIVE CARRIER METHOD

By

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Teams Link

Abstract

Hydrogels promise for bioinspired and biomedical applications, such as soft robotics, artificial muscles, and smart medicine owing to their physical properties similar to biological soft tissues. However, usage of hydrogels in these fields is still remaining a challenge because of mechanical and rheological properties, limited production methods, cytotoxicity. Here I will show manufacturing of 3D soft functional hydrogels by using a pneumatic-based extrusion bioprinter. Our functional hydrogel production approach is relied on a generalizable 3D printing method for building 3D structures of hydrogels using a fugitive carrier with shear-thinning properties. The fugitive carrier method, was developed by us, which allows to print the variety of hydrogel precursors with low viscosity with no modification on the final printed hydrogels, such as pre-crosslinking, addition of nanoparticles, guest–host shear-thinning formulation. The modular nature of this approach, together with the flexibility of additive manufacturing, allowed us to fabricate multimodular 3D structures with complex motions through the assembly of multiple functional components with programmed complex motions similar to seen in biological organisms. In addition, by the adopted method, we will able to create soft 3D bioprinting structures like in nature. General approaches to fabricate living cell encapsulated structures remain a challenge. Due to the low viscosity of cells in medium, it is not possible to print itself, so these processes require a scaffold, high solid friction or rheological modified bioinks that affect cell viability. However, none of them is required in this study, and our natural hydrogel bioinks that will encapsulate living cells in the 3D printing process. Results from this research will enable not only the rational design of cell-encapsulating soft materials with 3D printability and biocompatibility but also the high-resolution 3D printing of tissue structures.